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ABSTRACT

An indexing system to 1850 documents on library automation, systems studies in libraries, and indexing systems was developed for use in instruction and research. The indexing system consists of an on-line searched coordinate index, a printed coordinate index, a subject authority list, an abstract bulletin containing the 1850 documents in the index, computer-assisted instruction for index preparation, and searching, and a programmed text for teaching index preparation. The system has been used for instruction of graduate library school students in index preparation, searching, and evaluation. (Author)

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TECH MEMO

THE USE OF AN ON-LINE SEARCHED AND PRINTED COORDINATE INDEX IN TEACHING

G. Jahoda and Ferol A. Foos
School of Library Science

Tech Memo No. 40
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Duncan N. Hansen
Director
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THE USE OF AN ON-LINE SEARCHED AND PRINTED COORDINATE INDEX IN TEACHING

G. Jahoda and Ferol A. Foos

ABSTRACT

An indexing system to 1850 documents on library automation, systems studies in libraries, and indexing systems was developed for use in instruction and research. The indexing system consists of an on-line searched coordinate index, a printed coordinate index, a subject authority list, an abstract bulletin containing the 1850 documents in the index, computer-assisted instruction for index preparation and searching, and a programmed text for teaching index preparation. The system has been used for instruction of graduate library school students in index preparation, searching, and evaluation.

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G. Jahoda and Ferol A. Foos

I. Introduction

The objectives of this project are the development of an on-line searchable coordinate index called FOCUS (Florida State University On-line Coordinate Index Use Study) and its use in teaching and research. The project is carried out in the following stages:

1. Planning of indexing system;
2. Preparation of the first version of the index and its use in teaching;
3. Enlargement and refinement of the index and preparation of additional instructional material;
4. Use of the enlarged and refined index in teaching; and
5. Use of the enlarged and refined index in research.

In this report, the present state of the index will be summarized and the work carried out between September 1970 and May 1971 will be reported. This represents stages three and four of the project. Stages one and two have been reported (Jahoda & Foos, 1970) and will be summarized as needed for background.

FOCUS is centered around a decision making model of index preparation and use. The model which is depicted in Figure 1, has been used in classroom instruction, in computer-aided instruction, and in a programmed text.

The index now consists of about 1850 documents on library automation, systems studies in libraries, and indexing. The equipment used at the Computer-Assisted Instruction Center (CAI) is an IBM 1500 Instructional System consisting of an 1800 central processor with 32,000 words (16 bits)

of core, a 1502 station controller, sixteen 1510 CRT displays each with a keyboard and a light pen, one 1518 typewriter, and five disk drives with removable disk packs of 512,000 16-bit words (1.024 million bytes).

FOCUS now consists of:

1. an on-line computer searched coordinate index;
2. a printed coordinate index;
3. an abstract bulletin containing the indexed documents;
4. a subject authority list (Sal);
5. a computer-aided instruction program for index searching;
6. a computer-aided instruction program for index preparation; and
7. a programmed text for index preparation.

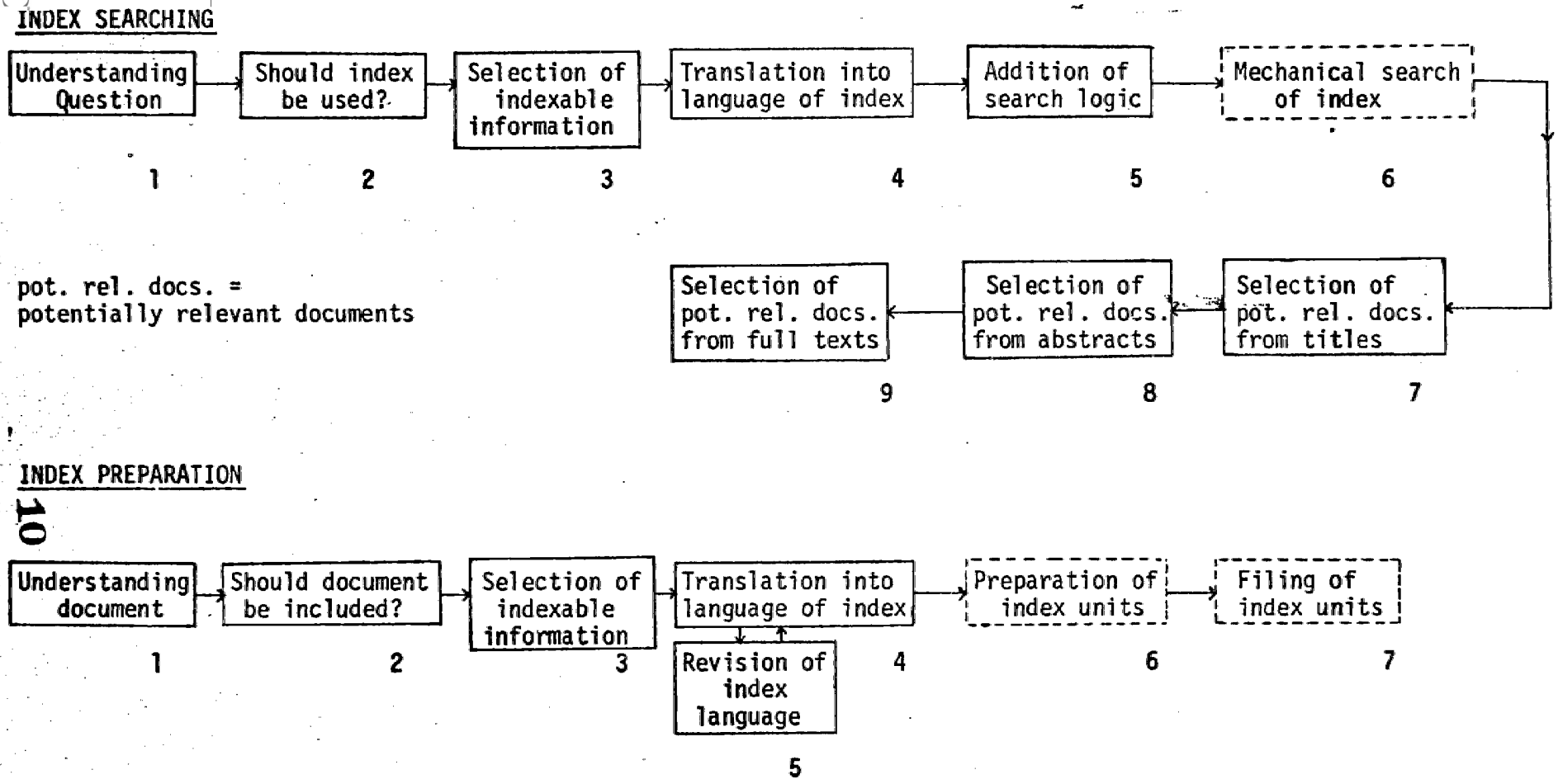


Figure 1. --Coordinate Index Searching and Preparation as Decision Making Steps

THE FOCUS INDEXING SYSTEM

The initial coordinate index to 700 documents, whose development is described in Tech Memo No. 22, had the following characteristics:

1. indexing based on abstracts;
2. indexing by subject, date of document, and type of document;
3. indexing as specifically as subject of document permits;
4. indexing on one level only;
5. controlled vocabulary by means of a subject authority list (Sal); and
6. no roles or links.

The testing of this index by a class of library school students brought out several deficiencies. Between June and September 1970, identified deficiencies were corrected and the indexed collection was increased from 700 to 1850 documents. The basic characteristics listed above were retained and are still applicable, although the following changes were made in the index at that time:

Word variants. Descriptors such as Editing, Editions, Editors, Files, Filing, and Verification, Verifiers were examined to determine whether they should be kept as separate index units or combined; and, if kept as separate descriptors, whether they should be connected by cross-references.

Scope notes. Scope notes were added to more descriptors, e.g., Planning, Information Analysis Centers, Space, to delineate their meaning in the index. The six types of document descriptors (Bibliographies, Case histories, Philosophy, Research, Reviews, and Surveys) were redefined in expanded scope notes to increase consistency of use by both searchers and indexers.

Hierarchical list. A hierarchical arrangement of descriptors was prepared as an aid in searching. The revised edition of the Sal includes the hierarchical list along with the alphabetic list of descriptors.

INDEX SEARCHING PROCEDURES

Instructions for on-line searching of FOCUS are given in Figure 2. Search statements can be made for as many as 20 descriptors combined with logical "and," "or," "not" connectors. The initial computer response is a display of the number of potentially relevant documents. The searcher has two separate options: he can ask the computer to display either the full bibliographic citation or he can specify the display of only the accession numbers of the potentially relevant documents. He may also renegotiate the search if either too many or not enough potentially relevant documents result from the specified search strategy.

The expansion of the index from 700 to 1850 documents caused a marked slowdown in on-line computer searching time when four or more searchers were on the consoles at the same time. Sample searches were run to determine the approximate time required for representative searches. Search time ranges for these searches were:

4 consoles used for FOCUS at the same time:	2.5 - 6 minutes
6 consoles used for FOCUS at the same time:	6 -13 minutes
8 consoles used for FOCUS at the same time:	5 -15 minutes

The slow response time with four or more students at consoles led to the following developments that will be briefly described: the inclusion of a printed index and an on-line search of a specified range of document numbers.

Computer printed coordinate index. The printed index was prepared because of the desirability of having a portable index that could be used at any time, as well as because of the slow machine response time. It consists of an alphabetically arranged list of descriptors without cross references.

Each descriptor unit contains a list of descriptor numbers representing documents indexed by the descriptor. The document numbers are arranged by terminal digit and in ascending order. A sample page of the index is given in Figure 3.

The printed index has been used for the following tasks, some of which are described more fully in other sections of the report:

1. Class demonstration of coordinate index searching;
2. Aid in selection of termpaper topics and bibliographies; and
3. Test searching of index (used in combination with on-line searched index).

Search of range of document numbers. The searcher may use either the entire data base or, by typing the lower and upper limit document numbers, use only a specified range within it. Searches on limited data bases require considerably less response time. When demonstrations of the system are given to large classes, each console is prepared with a set of questions and a data base limited for those questions. Should a person want to search the entire index, it is a simple two-step keying-in operation to gain access to the whole FOCUS data base of 1850 documents.

Figure 2. Instructions for on-line searching FOCUS

****

INSTRUCTIONS for On-Line Searching:

1. Get attention of the computer: Depress ALT CODE key, and while holding it down, press the INDEX key. When you see the cursor that marks typing line --
2. Type your identification code:)_____
3. Enter it into the computer: Depress the RETURN key. When cursor reappears --
4. Type either one of the following:
   a. For a display of bibliographic citations, type:)LOAD 3
   b. For a display of document numbers, only, type:)LOAD 4
5. Enter your typing by pressing the RETURN key. When cursor reappears --
6. To let the computer know you want to enter a logical search statement, type the letter: J
7. Press RETURN key to enter it. When the message "ENTER LOGICAL DESCRIPTION" appears on the screen --
8. Type your logical search statement which should consist of: descriptor numbers connected with "AND" "OR" "NOT" (parentheses, if needed)
9. After proofreading your typing, enter it by pressing RETURN key.
10. If, in step #4 you chose)LOAD 3, the computer will indicate the number of documents that are potentially relevant to your search statement. You now must use the light pen to indicate your choice of:
    a. viewing the first document citation, or
    b. returning to step #8 in order to type another search statement.
    (If you choose to view a document citation, you will use the light pen to make a choice at the end of each citation. Press the symbol before the word you choose. The point of the pen contacts a coded area.)
11. If, in step #4 you chose)LOAD 4, the computer will indicate the number of documents that are potentially relevant to your search statement and ask you to indicate with the light pen your choice of viewing or not viewing the numbers of these documents.
12. When you do not wish to continue entering logical statements, to get off the computer type: QUIT
13. Enter it by pressing the RETURN key. When the cursor reappears --
14. Type:)OFF
15. Enter it with RETURN key. The computer indicates time you have used.

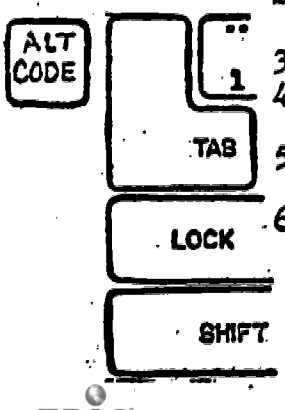
****

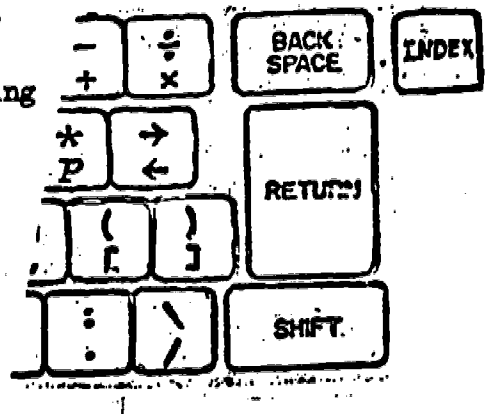
TO ERASE ERRORS MADE IN TYPING: (This can be done only before pressing the RETURN key.)

A. To erase one character at a time: Press the ALT CODE key, and while holding it down, press the BACK SPACE key as many times as needed.
B. To erase an entire line: Press the ALT CODE key and the upshift of the +.

? ? ? OTHER PROBLEMS ? ? ?

1. Did you remember to use the special APL characters (rather than the Coursewriter ones) when you were typing?
2. Did you proofread your typing before pressing the RETURN key to enter it into the computer?
3. Perhaps you confused 1 and l, or o and O?
4. Did you remember to enter your typing by pressing the RETURN key?
5. Did you get an error message? Call for help, when needed.
6. Is nothing happening?
   a. Perhaps the computer needs time for a lengthy search--or to service another terminal or terminals.
   b. Perhaps something is wrong with the system or your terminal. Are others able to use their terminals?





Closed circuit television 118

0	1	2	3	4	5	6	7	8	9
200	741	1042	523	24	585		47	798	1149
580				394	825		1807	1268	
				444					

Closed stack 811

0	1	2	3	4	5	6	7	8	9
	421								
	641								

COBOL 119

0	1	2	3	4	5	6	7	8	9
		832				226	947		709
		1022							

Codes 121

0	1	2	3	4	5	6	7	8	9
30	371	72	73	254	105	166	57	28	59
330	691	132	303	434	205	396	207	138	69
440	781	152	493	674	285	666	237	278	359
1080	1251	182	713		695	776	277	288	529
1240	1281	282	963		705	836	1177	458	809
1250	1311	472	1433		985	1196	1407	648	1369
1480		552	1543		1425	1406	1557	738	1489
1520		682	1553		1445	1626	1577	1118	
		1132	1613		1635		1627		
		1272	1663						
		1382							
		1692							
		1732							
		1862							

Collation 122

0	1	2	3	4	5	6	7	8	9
	691			204			737	698	359
								828	1299

Figure 3. Sample Page of printed index

DEVELOPMENT OF TEACHING MATERIALS

Computer-aided instruction. The original index searching exercise written in Coursewriter II and described in Tech Memo No. 22 has been completely revised. The new program, called SEARCH, includes six questions and retains the basic elements of the index searching operation, as stated in the decision-making-model. As in the previously used exercises; the correct answer in all but the first step is based on the correct answer given to the student for the previous step. The six questions (Appendix A) are on a printed handout which is used at the console. Sample CRT displays from SEARCH are given in Appendix B.

A major change in the Coursewriter program is the addition of immediate feedback to the student in the form of brief explanations of the correct answer to each question or step. This response appears regardless of the student's answer. Another change is the simulation of the actual searching of the index in the Coursewriter program instead of a searching of the index in the APL language. Until this change was made, the entire computer system had to be halted to change machine language. This was done only once during each of the students' two console sessions and every student had to complete the Coursewriter II sections (steps one through four as listed on the following pages) for each question before the machine change to the APL language could be made for step five. The machine language change took about five minutes. By eliminating the actual entry of the logical statement into the index for on-line searching and by instead simulating the index response, i.e. the display of potentially relevant document numbers, the student is able to work through all of the steps for each question in the correct order and progress at his own speed. Thus, in the revised version of the exercise, the student is given the document numbers resulting from the search rather than searching the index itself.

The initial step of the index searching exercise, question analysis, attempts to establish the student's understanding of the question. He considers each of five fictitious document titles as it appears on the CRT in relation to the question which he has in printed form. A three-level (relevant, possibly relevant, non-relevant) relevance judgment is made for each title. Following the student's relevance judgment, the correct answer for that document title with a brief explanation appears on the screen.

In step two, the student selects indexable information from the question. The printed form of the question has most words or phrases labelled with numbers in parentheses (Appendix A). The console screen displays each word or phrase in its original sequence and the student decides whether or not the term represents indexable information by selecting either the "yes" or "no" answer. The correct answer appears with an explanation when the next word or phrase is shown.

In step three, translation into descriptors, a divided screen initially displays as possible translation choices instructions, the indexable term to be translated, and several descriptor code numbers. The student uses the Sal for the vocabulary translation which should be to the one or more descriptors whose code numbers are shown on the screen. He then types the selected code numbers and, in response, is shown the descriptor in natural language for each of the pre-selected code numbers. Also given is a brief statement for each as to whether or not it is correct and why.

A revised format for step four, search logic formulation, was developed. The student is shown each descriptor and code number to be used, as well as a statement form of only the code numbers connected with blank spaces. The student types the necessary connectors ("and", "or", "not") and parentheses in these blanks to create the logical

statement. The correct statement is displayed after the student's response. This format proved to have mechanical limitations both in user operation and printout analysis. In view of this, the "free-form" response used in the original index searching Coursewriter II program when the student typed in the entire logical statement seems preferable.

In step five, the selection of relevant documents, the console screen displays the document numbers obtained for the question from a previous search of the index. The number of documents ranges from four to nineteen for the six questions. The student reads the document abstract in the Abstract Bulletin and indicates his three-level relevance judgment at the console. This format provides a summary and an item analysis of the relevance decisions as part of the computer printout, not, as in the original index searching exercise, on separate printed forms manually recorded by the student.

In early 1971, PREP, an index preparation exercise using computer-assisted instruction and comparable to SEARCH, was developed. PREP is also based on the five decision-making steps in the model, is written in Coursewriter II, and contains six abstracts with bibliographic citations which are reproduced on printed handouts used at the consoles. A sample abstract (printed handout) and sample CRT displays for PREP are given in Appendix C. Step one, the selection of documents for inclusion in the index, is presented on the screen as a series of eleven fictitious and very brief document abstracts. (These abstracts are different from the six used for steps two through six of the exercise.) For each of these abstracts the student decides whether or not it should be included in FOCUS and then he is shown the correct answer with an explanation. Step two, the selection of indexable information, has the same format as the

comparable step in the index searching exercise. The abstracts, in printed form, have numbers in parentheses following most words or phrases. The numbered terms per abstract vary from ten to sixteen. These terms are repeated on the console screen and the student decides whether or not the term is useful as indexable information by making a "yes" or "no" choice for each. A brief explanation accompanies the display of the correct answer. As a final part of step two, the student characterizes the abstract as one of the six types of documents used in the index or indicates that this type of descriptor does not apply.

The divided screen format for step three, the translation of indexable information into descriptors, is the same as that used for this step in SEARCH. For the six abstracts the number of terms to be translated ranges from six to ten per abstract. Translation is restricted to Sal descriptors which are exact matches (singular and plural forms of a word are considered exact matches) or stated equivalents of the terms. The console screen displays code numbers of descriptors which are possible translation choices (usually three) plus the additional choices of "Do not use" and "New Sal decision." After the student types in his answer of a number(s) or phrase, the full screen display identifies the descriptors of the code numbers and gives the correct "yes" or "no" answer with an explanation for each. The "New Sal decision" is the correct choice when the index vocabulary does not currently contain the indexable term as a descriptor (exact match) or a stated equivalent (see reference).

In step four there are four choices of a new Sal decision for a term:

1. Omit the concept entirely as not being important;
2. Make a "see" reference to a single existing descriptor;
3. Make a "see" reference to two or more existing descriptors; or
4. Create a new descriptor.

The terms presented in step four are those which required a "New Sal decision" in step three, translation into descriptors. The decision choice is based on the FOCUS Sal indexing rules with which the student is already familiar. After the student indicates his decision, the correct responses for each of the four choices with short explanations appear on the screen. If the correct answer is a "see" reference (choice 2 or 3 above), the next screen display shows the term and a statement of the type of Sal decision that is to be made. In a few instances the student is given the descriptor(s) to which a "see" reference is to be made, but usually he is presented a divided screen showing code numbers (the step three, translation, format). Using the Sal, he selects the descriptor(s) to be used in the cross-reference. The descriptors and correct responses with explanations for each code number appear after the student answers. If the new Sal decision is to create a new descriptor (choice 4 above), the student selects the correct BT (broader term).

Step five, updating the Sal is based, as were steps 2, 3, and 4 on the correct decision in the previous step. The screen format is essentially "free-form." For cross-references, the student is asked to type on the first frame the proper see reference and on the second frame the proper see from reference(s). For new descriptors the desired response is the proper descriptor entry followed by the NT (narrower term) entry under

the BT (broader term). The correct form of the Sal updating entry is displayed after the student enters his answer.

Programmed text. In early 1971, a programmed text was developed on index preparation to be used by the students in lieu of the computer-assisted instruction-based PREP program. Two limitations of the CAI program led to this decision. The first is the limited number of characters that can be displayed on the CRT at one time. There are sixteen lines on a screen, each with a maximum of forty characters. In practice, all sixteen lines of a screen cannot be used because of spacing considerations for readability and the need to save lines for student responses. This proved to be a problem, particularly in step five where a descriptor with a broad term and narrow terms and/or cross-references had to be displayed. The second limitation with multiple line responses also occurred in the same step. Students typically needed to enter two or more lines of answers for step five. This required different machine instructions for the first and second lines of input and caused the students difficulties.

The basic volume, called Coordinate Index Preparation: A Programmed Test (the CIP Text), uses branching throughout. It serves solely as a teaching device, requiring no written answers and nothing to be handed in by the student. Three separately bound exercises provide the student with practice in indexing three abstracts using the techniques learned with the programmed text. The CIP Text is based on rules for FOCUS and uses examples from the FOCUS Sal. For this reason, the student needs a copy of the FOCUS Sal when reading the text. Sample pages from the CIP Text are given as Appendix D.

The programmed text is based on the five decision-making steps in index preparation. An explanation is given with each correct answer for all exercises and examples, and clues or explanations are given

with all incorrect answers which lead the student to the correct answer.

Step one, the selection of documents for inclusion in the index, is explained and the FOCUS rules for selection are stated. Two examples are discussed before the student is presented with five documents as exercises in document selection.

A detailed presentation of the FOCUS rules introduces step two, the selection of indexable information. One document abstract, with most terms or phrases numbered, is given as an example for selecting index terms. The student then has two additional document abstracts, one with fourteen and one with fifteen terms, to use as exercises. Following each term is the correct answer, a brief explanation, and the FOCUS rule number upon which it is based. Each document also has a "type of document" descriptor choice.

The discussion of step three, translation of indexable information into descriptors, begins with the creation of a prototype or mini-Sal from a list of about twelve related terms. First the concepts are arranged hierarchically, then the Sal entries are established. One list serves as an example and the student is asked to create mini-Sals for two additional lists of terms. The correct hierarchies and Sal entries are given for all terms.

The FOCUS Sal rules are presented with examples of each. Then, the student has five indexable terms to translate into descriptors using the Sal. Detailed explanations of the correct answers are given.

The reasons for the four choices of new Sal decisions for step four are presented with specific examples of each. The student is given two terms as an exercise in choosing the correct new Sal decision.

The three types of entries for updating the Sal, step five, are illustrated with entries from the Sal. The student is given three exercises, each of which has four possible Sal entries for the answer.

There are three separately bound document abstract exercises which supplement the CIP Text. Each has a separate printed answer sheet on which the student records his initial responses. The exercises carry the documents through all five decision making steps in indexing. When an incorrect answer is chosen, a clue is given as to what is incorrect and/or what the right answer is. Explanations are given for all correct answers. References are made to rules and discussions in the CIP Text and to entries in the FOCUS Sal. The exercises are branched and the student must select the correct answer to any one segment to proceed.

THE USE OF FOCUS IN TEACHING

Demonstration of an on-line searched coordinate index to students in the introductory information science course. During the past year and a half, the index was used by students in LIS 586, Information Science and Libraries, as "hands on" experience with both an on-line searched computer and a coordinate index. LIS 586 is required of all master's students in the library school and is offered every term. FOCUS was demonstrated by means of half hour sessions at the console. During these sessions, students are asked to perform simple coordinate index searches already formulated for them. After the sample questions are completed and if time permits, students can search any other questions of interest to them. No formal evaluation was made of the sessions at the console but a number of students commented that the experience was useful in reinforcing material covered in the lectures and the readings.

Preparation of student papers with and without the aid of FOCUS. While the assignment of essays or papers based on a review of the literature is commonly used in a number of courses, including courses in library schools, relatively little is known about how students select topics for papers (when they don't have a file of previous papers to draw on) and how much time such exercises take. A small scale study was conducted, in part to answer the above questions and in part to determine whether FOCUS can be used as an aid for the preparation of papers. A class of thirty two students enrolled in LIS 586 was asked to prepare short papers on any one of the topics discussed in the course, topics that are also included in FOCUS. The papers were submitted in two parts. Part one, the part which provided data for this study, consisted of the title and outline of the paper, a short bibliography of at least

six items, a description of the methodology used in selecting the topic, preparing the outline and the bibliography, a record of the time taken for this task, and comments on the methodology used. Part two was the completed paper. The class was divided into two groups. The groups which were also used in the study of different teaching methods mentioned later in this section, were equal in number and comparable in terms of library school grade point averages and scores on the Graduate Record Examination. One group was instructed to use only FOCUS for the selection of the topic, preparation of the outline and bibliography. The other group was instructed to use any other tool or combination of tools except FOCUS.

The student prepared record of the methodology was not as complete as we had hoped to obtain and the sample is probably too small to permit any sweeping generalizations. Nevertheless, the following observations are reported:

Students in both groups typically selected two-concept topics with the concepts being combined as logical products, e.g. computers for selective dissemination of information; facsimile transmission and library networks; teletypewriters for interlibrary loans. The time taken for this task varied widely within the groups even though roughly similar products were turned in. The time range for the FOCUS group was 2 to 19 hours with an average of 8.4 hours. The time range for the non-FOCUS groups was 1 to 17 hours with an average of 7.8 hours. There is no statistical difference between these two groups at the 0.10 level as per Mann-Whitney U test, (Siegel, 1956).

Over half of the FOCUS group had difficulties in using the index for this purpose and/or expressed dissatisfaction at being restricted to a single tool. Three-fourths of the non-FOCUS group used two or more of the following tools: Library Literature, Library and Information Science

Abstracts, Information Science Abstracts, and Research in Education. One-fourth of the non-FOCUS group used Library Literature only. Difficulties in selecting a topic were encountered by both groups. These included insufficient acquaintance with the field for querying the index, redundancy of the literature, and unavailability in the library of the selected references. Results from this study suggest that FOCUS, or any other single tool for that matter, should not be used for such an exercise and that a more extensive study of the rationale for assigning papers and method of preparation and evaluation might be useful.

Comparison of lecture and multi-media methods for teaching index searching. In LIS 586, indexes are discussed from a user's (searcher) rather than a producer's (indexer) point of view. This topic takes up about one third of the course. With the exception of the aforementioned demonstration of FOCUS and an index searching exercise, the subject is presented primarily via the lecture method. During the winter and spring terms of 1970/71, a portion of LIS 586 students were exposed to indexes via multimedia rather than the lecture method. Miss Drucilla Motley, one of the doctoral students of the School of Library Science, has prepared as part of her dissertation tape-slide presentations, programmed texts, and computer assisted instruction for presenting this material. The difference between the lecture and multimedia teaching methods in terms of pre-test/post-test scores, attitude changes toward subject, and time taken by students is now being analyzed. The results of this study will be reported in Miss Motley's dissertation.

The use of FOCUS in the abstracting and indexing course. The objective of the indexing section of LIS 587, the five quarter hours abstracting and indexing course, is to acquaint students with the

techniques as well as the problems of index preparation and evaluation. This was done during the seven weeks segment of the course devoted to indexing by means of the following steps:

1. Instruction in indexing
2. Student indexing
3. Planning of index evaluation
4. Carrying out index evaluation
5. Discussion of results of index evaluation

The eleven students enrolled in this course in the Spring term of 1971 had been introduced to FOCUS searching as students in LIS 586. Index preparation was taught by means of the previously mentioned programmed text. Students were given a pre-test prior to reading the programmed text and doing the associated exercises. A post-test was given at the completion of the reading of the programmed text and the indexing exercises. The pretest/posttest is reproduced as Appendix E. The pre-test scores range from 60% to 76% and average 68%. The posttest scores range from 68% to 98% and average 87%. No comparable data is available for teaching index preparation with the aid of the previously used classroom instruction method since no equivalent tests were used with this technique. The relatively high scores in the pre-test are attributable to the students' exposure to FOCUS searching in LIS 586 and to the similarity between the steps in index searching and preparation. At the completion of the posttest, students indexed three common document abstracts in class. Then each student was given five different abstracts to index. Index entries for the 55 document abstracts so obtained were added to the on-line searched index, new indexing decisions were included in a supplement to the Sai, and a supplement to the abstract bulletin was prepared. The indexing was followed by a class discussion of index evaluation and a plan for conducting an index evaluation. The class

decided that each student should formulate one question based on a document indexed by another student (a single source document question) and four questions based on searching the entire document collection, now over 1900 documents. The latter type of questions is to yield between two and fifteen documents. No restrictions were placed on allowable search strategy. The search results in terms of relevant and non-relevant documents and the search strategy used for each question were recorded on a form designed by the students. The completed forms were used to calculate recall and precision ratios as well as for analysis of reasons for search failure. Relevance was judged on a two level basis (relevant and non-relevant) from reading the document abstract. The searcher was not permitted to negotiate the question with the search formulator since the students felt that such negotiation might result in a giving away of the answers. Eleven single source document questions and twenty one multiple document questions were searched by the students. A number of questions were eliminated because they were either duplicate of or closely related to questions on the list. One question was eliminated because the search formulator used incorrect search logic in answering his own question. Each student searched one single source document question and at least five other questions assigned to him. Several students used the printed index for both preliminary question formulation and searching. The complexity of the search logic made the on-line mode more suitable for later search stages. Search results recorded on the previously mentioned form were analyzed by the search formulator. His first task was to compare relevant documents that he selected with those selected by the individual searchers. If additional relevant documents were located by the searchers, the search formulator decided whether or not to accept these documents as relevant. Acceptance of additional relevant documents required an adjustment of search results for calculation

of recall and precision ratios as well as for characterizing reasons for non-retrieval of relevant documents. The most common reasons for non-retrieval of relevant documents listed in decreasing order of occurance were: difference in relevance judgment between search formulator and searcher, inadequate translation of indexable information in the question into descriptors, inadequate search strategy - search too specific, inadequate search strategy - search too generic, misunderstanding of question, and clerical error.

In lieu of a final examination for this portion of the course, students were asked to prepare a case history of the index evaluation exercise and to comment on this experience. The case histories indicate an understanding of the problems in index preparation, searching, and evaluation. Several suggestions aimed at improving the index evaluation procedure were made. These include suggested changes in the search record form, the recording and subsequent analysis of search strategies that yield no relevant documents, and the use of questions posed by students in another class to make the test more realistic.

The objectives of the indexing section of this course are to acquaint students with index preparation and evaluation. These are broadly stated objectives whose achievements are difficult to measure. We cannot present quantitative measures of student performance. However, it is our impression from reading the case histories turned in by the students and watching their performance that the index evaluation exercise presented the students with a challenge. They responded well to this challenge by working at least as hard as was expected of them and by coming up with conclusions about index preparation and evaluation that were not novel but showed an insight into the problems involved.

FUTURE PLANS

We plan to continue the use of FOCUS to demonstrate on-line searches of coordinate indexes in the introductory information science course and for index preparation, searching, and evaluation in the abstracting and indexing course. It is our hope that the program can be run on the University's CDC 6400 Computer which now has on-line searching facilities. The principle advantage of using the CDC 6400 would be the greatly reduced search time on this more powerful computer.

The indexing system will also be used as a testbed for determining the effect of changes in different components of the index on index performance. Variables to be tested include question characteristics, index vocabulary, and search output. Also planned is the use of the techniques and programs developed in the course of this study for the preparation of indexes to other data bases as for example an inventory of skills of the Florida State University faculty. We would like to prepare both a printed and an on-line searched "Who Knows What" directory. This is to serve as an aid in connecting individuals with a need for information with individuals that have the needed information. Case histories of the use of the system are to be collected both to study system performance and this aspect of information gathering habits of members of an academic community.

FOOTNOTES

1 The work for this project was made possible through funds from the Office of Naval Research, Project NR 154-280. We are grateful for this support. The authors also wish to thank Tom McMurchie for his programming work.

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APPENDICES

APPENDIX A

QUESTIONS USED FOR THE CAI COURSEWRITER II

INDEX SEARCHING EXERCISE (SEARCH)

1. Does (1) a (2) public library (3) in California (4) use (5) phototypesetting machines (6)?
2. I am looking (1) for a public library (2) which has all or part (3) of its bindery operations (4) computerized (5).
3. Have keyword from title indexes (1) been used (2) in biology (3)? Fields (4) closely related to biology will be acceptable (5).
4. Is there anything (1) written on centralized (2) reference referral networks (3) dealing (4) specifically (5) with maps (6) and charts (7)?
5. Are there any (1) discussions (2) of reasons (3) for failures (4) or (5) false drops (6) in machine searches (7)?
6. Are (1) any school libraries (2) using (3) computer terminals (4)?

APPENDIX B

SAMPLE CRT SCREEN DISPLAYS FROM SEARCH, A CAI PROGRAM

QUESTION ANALYSIS: Select documents for Question 2. Document title:

University of Sussex automated housekeeping byproducts included request forms, accession lists and bindery records.

☐ Relevant ☐ Non-relevant ☐ Possibly rel

Non-relevant; not a public library.

☐ Continue

SELECT INDEXABLE INFORMATION: Question 2
1. looking
☐ Yes ☐ No
No-carries no meaning
2. public library
☐ Yes ☐ No
Yes-organization
3. all or part
☐ Yes ☐ No
No-can't search this specifically
4. bindery operations
☐ Yes ☐ No
Yes-information service or operation

☐ Continue

TRANSLATE WITH SAL: Question 2 (Type number of each descriptor to be used)

public library	
Public libraries	508-Yes-match
Regional libraries	539-Yes-SA of Public libraries; related
State libraries	612-Yes-SA of Public libraries; related

☐ Continue

Sample CRT screen displays from SEARCH - **continued**

SEARCH LOGIC: Question 2
Type "and" "or" "not" "(" ")" in blanks
57 Binding; 508 Public libraries; 539
Regional libraries; 612 State libraries

--57------508------539------612--

57 and (508 or 539 or 612)

☐ Continue

DOCUMENT SELECTION: Question 2
Characterize relevance of each document
using Abstract Bulletin.
Document 531 ☐ Rel ☐ Non-rel ☐ **Possibly rel**
Possibly relevant; "aims" doesn't clarify
if it's operational or only planned for.

Document 844 ☐ Rel ☐ Non-rel ☐ **Possibly rel**
Non-relevant; binding of computer-
produced catalog.

Document 1273 ☐ Rel ☐ Non-rel ☐ **Possibly rel**
Possibly relevant; machine portion of
system may include binding.

☐ Continue

APPENDIX C

SAMPLE ABSTRACT AND CRT DISPLAYS FROM PREP

A CAI COURSEWRITER II EXERCISE

IN INDEX PREPARATION

Sample abstract
index preparation

Magnavox (1) vs. LDX (2) in interlibrary loans (3). Vincent Burgess. ALA Bull, 35, 727-729, Nov 69 (4). 2 illus. 1 table.

An (5) experiment (6) in using (7) the Magnavox telecopier (1) and Xerox LDX facsimile transmission (2) for interlibrary loans (3) of journals (8). The (9) expense (10) and rapidity (11) of the equipment (12) were compared (13). The results (14) were reported (15) at a 1968 (16) meeting.

Sample CRT screen displays

SELECT INDEXABLE INFORMATION: Abstract 1
1. Magnavox telecopier
☐ Yes ☐ No
Yes-name of equipment
2. Xerox LDX facsimile transmission
☐ Yes ☐ No
Yes-name of equipment
3. interlibrary loans
☐ Yes ☐ No
Yes-information service or operation
4. 69
☐ Yes ☐ No
Yes-date of publication
5. An
☐ Yes ☐ No
No-carries no meaning

☐ Continue

---

[1] Student answers are not shown, but CRT responses (the correct answers) that follow student answers are shown here.

SELECT INDEXABLE INFORMATION: Abstract 1
type of document
Check the correct answer:
Bibliography ☐
Case histories ☐
Philosophy ☐
Research ☐
Reviews ☐
Surveys ☐
Does not apply ☐

Research - an experiment is research

☐ Continue

TRANSLATE WITH SAL: Abstract 2 (Type descriptor number(s) to be used or phrase
Xerox LDX facsimile transmission

Data transmission equipment	165-No-too broad
Telefacsimile	646-Yes-see reference
Copiers, photocopying	201-No-see=ref from Xerox 914 not Xerox LDX
Do not use	-No-equipment is indexed
New sal decision	-No-see reference exists in sal

☐ Continue

Abstract 2
New sal decision: Magnavox telecopier
A. Choice of decisions (check only one)

1. Omit concept ☐ No-types of equipment are indexed
2. See ref to single existing descriptor ☐ Yes-specific descriptor for telecopiers is available
3. See ref to two or more existing descriptors ☐ No-single descriptor is adequate

4. New descriptor ☐ No-existing descriptor is adequate

☐ Continue

New sal decision: Magnavox telecopier

Magnavox telecopier will be added to the sal by expanding the existing descriptor "Telefacsimile" with a cross reference.

☐ Continue

New sal decision: Magnavox telecopier
B. Update sal: type "see" reference(s) to existing descriptor(s). Don't type BT's, scope notes, NT's, X's, SA's that are already printed in the sal.

Magnavox telecopier see Telefac-
simile 646

☐ Continue

New sal decision: Magnavox telecopier
B. Update sal: type "see from" reference(s) of existing descriptor(s). Don't type BT's, scope notes, NT's, X's, SA's that are already printed in the sal

Telefacsimile 646
X Magnavox telecopier

☐ Continue

APPENDIX D

SAMPLE PAGES FROM COORDINATE INDEX PREPARATION,

A PROGRAMMED TEXT

Programmed Text, bottom of p. 49

Indexable information term #4: Chained storage

Programmed Text, p. 50

The see reference for the process Chained storage is on SAL p. 32. It refers to two descriptors connected by "and" which, of course, means that the concept "chained storage" must be characterized by both of these descriptors each time it is indexed or searched in FOCUS. Under the descriptor Storage, of words in computer 617, SAL p. 221, you will find the see from (X) reference for Chained storage followed by Distribution in parentheses which indicates that both descriptors are required for this concept. This kind of tracing also provides the editor with complete information for SAL revision. It leads him to all of the SAL locations of this concept. If he was revising the descriptor Distribution 183, SAL p. 62, he could follow the tracings and make the necessary changes under Chained storage, Storage, of words in computer, etc.

Indexable information term #5: Science Citation Index

Programmed Text, top of p. 51

The see reference for the information source Science Citation Index is on SAL p. 206. It refers to the subject descriptor, Science and technology, and to two types of publication descriptors, Citation indexes and Information sources, machineable, in compliance with the SAL rule for information sources (p. 44).

On SAL p. 206 the descriptor Science and technology 572
has the X reference for Science Citation Index. In parentheses following it are the two additional descriptors that are required to represent this concept in FOCUS. By looking up both of these terms in the SAL (pp. 106-107 for Information sources, machineable, and p. 35 for Citation indexes) you can see the full tracings for this concept.

Programmed Text, p. 70

In this exercise you will select the letter of the correct SAL updating for each of three terms. (Be sure the answer you select is complete.)

SAL Updating exercise #1: term: Layout
index language equivalent: Formats 223
select a see-reference to update the SAL

A. Layout
BT Properties, other

Properties, other
NT Layout
NT Formats

B. Formats 223 see Layout

Layout see Formats 223

C. Formats 223
X Layout

Layout see Formats 223

D. Formats 223
SA Layout

Layout see Formats 223

If you select answer A go to p. 71
If you select answer B go to p. 72
If you select answer C go to p. 73
If you select answer D go to p. 74

Programmed Text, p. 71

If you chose answer A for Layout you will probably want to review p. 67 on see references. Remember that BT and NT establish a place for the term in the hierarchy which means the term becomes a descriptor.

After you review p. 67 return to p. 70 to try again.

Programmed Text, p. 72

If you chose answer B for Layout you will probably want to review p. 67 on see references. Remember the see reference must have a see from reference going in the other direction.

After you review p. 67 return to p. 70 to try again.

Programmed Text, p. 73

GOOD.

Answer C is correct for Layout. Layout is the equivalent to Formats so only one term needs to be used as a descriptor. Since Formats is an established descriptor, the see from (X) reference is added to it and a see reference is added to the SAL.

Continue to p. 75.

Programmed Text, p. 74

If you chose answer D for Layout you will probably want to review p. 67 on see references. Remember that the see reference must have a see from reference going in the other direction.

After you review p. 67, return to p. 70 to try again.

APPENDIX E

COORDINATE INDEX PREPARATION - Test

Please record your answers on the separate answer sheet provided. Answer each question in the established order.

Document Abstract

Tests (1) of Uniroyal Microfilm Retrieval System (2). USA Libr. Bull., 84, 42-43, May 68 (3). 2 illus.

Results (4) of the ALA Library Technology Program (5) tests (1) of the Uniroyal Microfilm Retrieval System (2) are presented. The miniaturization ratio (6) of the microfilm (7) exceeds (8) any other microform (9) available in 1967 (10). Durability (11) of the cassettes (12) was questioned (13) by the Phillips Petroleum Company Library (14) which has used the system (2) one year (15) inconjunction with a larger information storage and retrieval system (16) using the Honeywell 1200 computer (17). The entire system (16) is written in JOVIAL programming language (18).

Step 1 is Selection of Documents for inclusion in the index.

You need to decide if this document abstract should be included in FOCUS, considering the subject matter, date of publication and language. Circle your answer on the answer sheet.

Step 2 is the Selection of Indexable Information.

Listed below are each of the numbered terms in the abstract. Decide for each term if it should be selected as indexable information. Circle your answer for each on the answer sheet.

1. tests
2. Uniroyal Microfilm Retrieval System
3. 68
4. results
5. ALA Library Technology Program
6. miniaturization ratio
7. microfilm
8. exceeds
9. microform

Step 2. Selection of Indexable Information - continued

10. 1967
11. durability
12. cassettes
13. questioned
14. Phillips Petroleum Company Library
15. one year
16. information storage and retrieval system
17. Honeywell 1200 computer
18. JOVIAL programming language

Step 3 is Translation into Descriptors.

You are given each term of indexable information separately accompanied by a list of descriptor code numbers and phrases. The numbers are the actual descriptor codes given in the SAL (Subject Authority List). Two different phrases are usually included in the answer list. One phrase, "Do not use," should be selected when the indexable term has already been used (indexed) for that document or when a narrower (more specific) level descriptor has already been used (indexed) for the document. The second phrase, "New SAL decision," should be selected when you cannot translate the indexable term into descriptors through the SAL and a new index vocabulary decision is required.

You should select only the SAL descriptors that are exact matches or stated equivalents (see references) of the units of indexable information. The plural form of a word is considered an exact match.

Example: Catalog can be translated into the descriptor "Catalogs 93" because the plural word form is considered an exact match.

Test 3

Step 3. Translation into Descriptors - continued

Example: General Motors Library cannot be translated into the descriptor "Industrial libraries 281" because the following cross references (stated equivalents) are not in the SAL on pp. 82-83 and 101-102:

General Motors Library see Industrial libraries 281

Industrial libraries 281
...
...
X General Motors Library

To do the translation step, look up the indexable term in the SAL and try to translate it into the index language. The answer you decide on should be included in the accompanying list of numbers and phrases. Circle your answer(s) for each term.

Indexable information 1, Tests
translation choices:

623
651
206
Do not use
New SAL decision

Indexable information 2, Uniroyal Microfilm Retrieval System
translation choices:

400
731
403
Do not use
New SAL decision

Indexable information 3, 68
translation choices:

716
900
902
913
Do not use

Test 4

Step 3. Translation into Descriptors - continued

Indexable information 4. ALA Library Technology Program
translation choices:

340
28
Do not use
New SAL decision

Indexable information 5. miniaturization ratio
translation choices:

522
530
820
Do not use
New SAL decision

Indexable information 6. microfilm
translation choices:

398
784
400
Do not use
New SAL decision

Indexable information 7. microform
translation choices:

404
400
398
Do not use
New SAL decision

Indexable information 8. durability
translation choices:

351
707
Do not use
New SAL decision

Test 5

Step 3. Translation into Descriptors - continued

Indexable information 9, cassettes
translation choices:

402
400
89
Do not use
New SAL decision

Indexable information 10, Phillips Petroleum Company Library
translation choices:

284
281
794
282
New SAL decision

Indexable information 11, information storage and retrieval system
translation choices:

295
911
577
Do not use
New SAL decision

Indexable information 12, Honeywell 1200 computer
translation choices:

252
852
204
Do not use
New SAL decision

Indexable information 13, JOVIAL programming language
translation choices:

495
119
328
Do not use
New SAL decision

Test 6

Step 4 is New SAL Decisions.

When no descriptor or stated equivalent exists in the SAL for a unit of indexable information, the indexer has four choices for a new SAL decision. Circle the number of your answer for each term on the answer sheet.

Indexable information 1. Uniroyal Microfilm Retrieval System
Step 4. New SAL Decision:

1. Omit the concept entirely
2. Make a see reference to a single existing descriptor
3. Make a see reference to two or more existing descriptors
4. Create a new descriptor

Circle the number on the answer sheet.

Indexable information 2. miniaturization ratio
Step 4. New SAL decision.

Is the new SAL decision choice #1, Omit the concept entirely, the correct decision for this term? Circle "Yes" or "No" on the answer sheet.

Indexable information 3. durability
Step 4. New SAL Decision

Is the new SAL decision choice #1, Omit the concept entirely, the correct decision for this term? Circle "Yes" or "No" on the answer sheet.

Indexable information 4. Phillips Petroleum Company Library
Step 4. New SAL Decision.

1. Omit the concept entirely
2. Make a see reference to a single existing descriptor
3. Make a see reference to two or more existing descriptors
4. Create a new descriptor

Circle the number on the answer sheet.

Test 7

Indexable information 5. Honeywell 1200 computer
Step 4. New SAL Decision.
1. Omit the concept entirely
2. Make a see reference to a single existing descriptor
3. Make a see reference to two or more existing descriptors
4. Create a new descriptor
Circle the number on the answer sheet.

Indexable information 6. JOVIAL programming language
Step 4. New SAL Decision.
1. Omit the concept entirely
2. Make a see reference to a single existing descriptor
3. Make a see reference to two or more existing descriptors
4. Create a new descriptor
Circle the number on the answer sheet.

Test 8

Step 5. Updating the SAL

After a new indexing decision has been made, the SAL must be updated (revised) to reflect the change. Circle the letter of your answer for each term on the answer sheet.

Indexable information 1. Uniroyal Microfilm Retrieval System
Step 5. Updating the SAL
Descriptor: Microform search systems 403
Expand an existing descriptor with a see reference. Circle the letter on the answer sheet.

A. Microform search systems 403
NT Uniroyal Microfilm Retrieval System

Uniroyal Microfilm Retrieval System
BT Microform search systems

B. Microform search systems 403
NT Uniroyal Microfilm Retrieval System

Uniroyal Microfilm Retrieval System see Microform search systems 403

C. Microform search systems 403
X Uniroyal Microfilm Retrieval System

Uniroyal Microfilm Retrieval System See Microform search systems 403

D. Uniroyal Microfilm Retrieval System see Microform search systems 403

Test 9

Indexable information 2. miniaturization ratio
Step 5. Updating the SAL.
Descriptor: Reduction ratio 820
Expand the existing descriptor with a see reference. Circle the letter on the answe/ sheet.

A. Miniaturization ratio
BT Reduction ratio

Reduction ratio 820
NT Miniaturization ratio

B. Miniaturization ratio see Reduction ratio 820

Reduction ratio 820
X Miniaturization ratio

C. Miniaturization ratio see Reduction ratio 820

Reduction ratio 820
SA Miniaturization ratio

D. Miniaturization ratio 820
X Reduction ratio

Reduction ratio see Miniaturization ratio 820

Test 10

Step 5. Updating the SAL.

Indexable information 3. durability
Descriptor: Wear 707
Expand the existing descriptor with a see reference. Circle the letter on the answer sheet.

A. Durability see Wear 707

Wear 707
X Durability

B. Durability 707
X Wear

Wear see Durability 707

C. Durability
SA Wear

Wear 707
SA Durability

D. Durability see Wear 707

Wear see also Durability

Test 11

Step 5. Updating the SAL.

Indexable information 4. Phillips Petroleum Company Library
Descriptors: Industrial libraries 281
Petroleum 794
Expand the existing descriptors with a see reference. Circle the letter on the answer sheet.

A. Industrial libraries 281
X Phillips Petroleum Company Library

Petroleum 794
X Phillips Petroleum Company Library

Phillips Petroleum Company Library see Industrial libraries 281 and Petroleum 794

B. Industrial libraries 281
NT Phillips Petroleum Company Library

Petroleum 794
NT Phillips Petroleum Company Library

Phillips Petroleum Company Library see Industrial libraries 281 and Petroleum 794

C. Industrial libraries 281
X Phillips Petroleum Company Library (Petroleum)

Petroleum 794
X Phillips Petroleum Company Library

Phillips Petroleum Company Library see Industrial libraries 281 and Petroleum 794

D. Industrial libraries 281
X Phillips Petroleum Company Library (Petroleum)

Petroleum 794
X Phillips Petroleum Company Library (Industrial libraries)

Phillips Petroleum Company Library see Industrial libraries 281 and Petroleum 794

Test 12

Indexable information 5. Honeywell 1200 computer
Step 5. Updating the SAL.
Descriptor: Honeywell 1200 computer 2603
BT: Computers
No scope note, NT, X, or SA.
Create a new descriptor. Circle the letter on the answer sheet.

A. Computers
X Honeywell 1200 computer 2603

Honeywell 1200 computer 2603 see Computers

B. Computers
BT Honeywell 1200 computer

Honeywell 1200 computer 2603
NT Computers

C. Computers
NT Honeywell 1200 computer 2603

D. Computers
NT Honeywell 1200 computer

Honeywell 1200 computer 2603
BT Computers

Test 13

Indexable information 6. JOVIAL programming language
Step 5. Updating the SAL.
Descriptor: JOVIAL 1768
BT: Program languages 495
No scope note, NT, X, or SA.
Create a new descriptor. Circle the letter on the answer sheet.

A. JOVIAL 1768
SA Program languages

Program languages 495
SA JOVIAL

B. JOVIAL 1768
BT Program languages

Program languages 495
NT JOVIAL

C. JOVIAL 1768
BT languages

Program languages 495
NT JOVIAL

D. Languages 328
NT Program languages 495
NT JOVIAL 1768

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Glenview, IL 60026

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Washington, DC 20380

1 Dr. James J. Regan, Code 55
Naval Training Device Center
Orlando, FL 32813

3 Commanding Officer
Naval Personnel and Training Research Laboratory
San Diego, CA 92152

1 Chairman
Behavioral Science Department
Naval Command and Management Div.
U.S. Naval Academy
Luce Hall
Annapolis, MD 21402

1 Superintendent
Naval Postgraduate School
Monterey, CA 93940
ATTN: Library (Code 2124)

1 Information Systems Programs
Code 437
Office of Naval Research
Arlington, VA 22217

1 Commanding Officer
Service School Command
U.S. Naval Training Center
San Diego, CA 92133

1 Technical Library
Naval Ordnance Station
Indian Head, MD 20640

1 Mr. George N. Graine
Naval Ship Systems Command (SHIP 03H)
Department of the Navy
Washington, D.C. 20360

1 Col. George Caridakis
Director, Office of Manpower Utiliz.
Headquarters, Marine Corps (A01H)
MCB
Quantico, VA 22134

1 Dr. A. L. Slafkosky
Scientific Advisor (Code AX)
Commandant of the Marine Corps
Washington, D.C. 20380

ARMY

1 Behavioral Sciences Division
Office of Chief of Research and Development
Department of the Army
Washington, D.C. 20310

1 U.S. Army Behavior and Systems Research Laboratory
Commonwealth Building, Room 239
1320 Wilson Boulevard
Arlington, VA 22209

1 Director
Behavioral Sciences Laboratory
U.S. Army Research Institute of Environmental Medicine
Natick, MA 01760

1 Armed Forces Staff College
Norfolk, VA 23511
ATTN: Library

1 Director of Research
US Army Armor Human Research Unit
ATTN: Library
Bldg 2422 Morande Street
Fort Knox, KY 40121

1 Commandant
U.S. Army Adjutant General School
Fort Benjamin Harrison, IN 46216
ATTN: ATSAG-EA

1 Division of Neuropsychiatry
Walter Reed Army Institute of Research
Walter Reed Army Medical Center
Washington, D.C. 20012

AIRFORCE

1 AFHRL (TR/Dr. G. A. Eckstrand)
Wright-Patterson Air Force Base
Ohio 45433

1 AFSOR (NL)
1400 Wilson Boulevard
Arlington, VA 22209

1 HQ, AFSC (SDEC)
Andrews Air Force Base
Washington, D.C. 20330

1 Personnel Research Division (AFHRL)
Lackland Air Force Base
San Antonio, TX 78236

1 Commandant
U.S. Air Force School of Aerospace Medicine
ATTN: Aeromedical Library
Brooks AFB, TX 78235

1 Director of Manpower Research
OASD (M&RA) (M&RU)
Room 3D960
The Pentagon
Washington, D.C.

1 AFHRL (TRT/Dr. Ross L. Morgan)
Wright-Patterson Air Force Base
Ohio 45433

1 Lt. Col. Robert R. Gerry, USAF
Chief, Instructional Technology Programs
Resources & Technology Division (DPTBD DCS/P)
The Pentagon (Room 4C244)
Washington, D.C. 20330

1 Director
Air University Library (AUL-8110)
Maxwell Air Force Base,
Alabama, 36112

1 Headquarters, Electronics Systems Division
ATTN: Dr. Sylvia Mayer/MCDS
L.G. Hanscom Field
Bedford, MA 01730

OTHER GOVERNMENT

1 Mr. Joseph J. Cowan, Chief
Psychological Research Branch (P-1)
U.S. Coast Guard Headquarters
400 Seventh Street, S.W.
Washington, D.C. 20591

1 Dr. Andrew R. Molnar
Computer Innovation in Education Section
Office of Computing Activities
National Science Foundation
Washington, D.C. 20550

1 Dr. Alvin E. Goins, Chief
Personality and Cognition Research Section
Behavioral Sciences Research Branch
National Institute of Mental Health
5454 Wisconsin Ave., Room 10A01
Washington, D.C. 20015

MISCELLANEOUS

1 Dr. John Annett
Department of Psychology
Hull University
Hull
Yorkshire, England

1 Dr. Bernard M. Bass
University of Rochester
Management Research Center
Rochester, NY 14627

Dr. Jaime Carbonell
Bolt, Bernanek and Newman
50 Moulton Street
Cambridge, MA 02138

1 ERIC Clearinghouse on
Educational Media and Technology
Stanford University
Stanford, CA 94305

1 Lawrence B. Johnson
Lawrence Johnson & Associates, Inc.
2001 "S" St. N.W.
Washington, DC 20037

1 Dr. Albert S. Glickman
American Institutes for Research
8555 Sixteenth Street
Silver Spring, MD 20910

1 Mr. Roy Ference
Room 2311
U.S. Civil Service Commission
Washington, DC 20415

1 Dr. Richard C. Atkinson
Department of Psychology
Stanford University
Stanford, California 94305

1 Dr. Mats Bjorkman
University of Umea
Department of Psychology
Umea 6, Sweden

1 Dr. David Weiss
University of Minnesota
Department of Psychology
Elliot Hall
Minneapolis, MN 55455

1 ERIC Clearinghouse on Vocational and Technical Education
The Ohio State University
1900 Kenny Road
Columbus, OH 43210
ATTN: Acquisition Specialist

1 Dr. Robert Glaser
Learning Research and Development Center
University of Pittsburgh 15213

1 Dr. Bert Green
Department of Psychology
Johns Hopkins University
Baltimore, MD 21218

1 Dr. Duncan N. Hansen
Center for Computer Assisted Instruction
Florida State University
Tallahassee, FL 32306

1 Dr. Richard S. Hatch
Decision Systems Associates, Inc.
11428 Rockville Pike
Rockville, MD 20852

1 Human Resources Research Organization
Library
300 North Washington Street
Alexandria, VA 22314

1 Human Resources Research Organization
Division #4, Infantry
Post Office Box 2086
Fort Benning, Georgia 31905

1 Human Resources Research Organization
Division #6, Aviation (Library)
Post Office Box 428
Fort Rucker, Alabama 36360

1 Dr. Robert R. Mackie
Human Factors Research, Inc.
Santa Barbara Research Prak
6780 Cortona Drive
Goleta, CA 93017

1 Mr. Luigi Petrullo
2431 North Edgewood Street
Arlington, VA 22207

1 Dr. Diane M. Ramsey-Klee
R-K Research & System Design
3947 Ridgemont Drive
Malibu, CA 90265

1 Dr. Len Rosenbaum
Psychology Department
Montgomery College
Rockville, MD 20850

1 Dr. Robert J. Seidel
Human Resources Research Organization
300 N. Washington Street
Alexandria, VA 22314

1 Dr. M. D. Havron
Human Sciences Research, Inc.
Westgate Industrial Park
7710 Old Springhouse Road
McLean, VA 22101

1 Human Resources Research Organization
Division #3
Post Office Box 5787
Presidio of Monterey, CA 93940

1 Human Resources Research Organization
Division #5, Air Defense
Post Office Box 6021
Fort Bliss, TX 77916

1 Dr. Roger A. Kaufman
Graduate School of Human Behavior
U.S. International University
8655 E. Pomerada Road
San Diego, CA 92124

1 Office of Computer Information
Center for Computer Sciences and Technology
National Bureau Standards
Washington, D.C 20234

1 Psychological Abstracts
American Psychological Association
1200 Seventeenth Street, N.W.
Washington, D.C. 20036

1 Dr. Joseph W. Rigney
Behavioral Technology Laboratories
University of Southern California
University Park
Los Angeles, CA 90007

1 Dr. George E. Rowland
Rowland and Company, Inc.
Post Office Box 61
Haddonfield, NJ 08033

1 Dr. Arthur I. Siegel
Applied Psychological Services
Science Center
404 East Lancaster Avenue
Wayne, PA 19087

1 Benton J. Underwood
Department of Psychology
Northwestern University
Evanston, IL 60201

1 Mr. C. R. Vest
6225 Nelway Drive
McLean, Virginia 22101